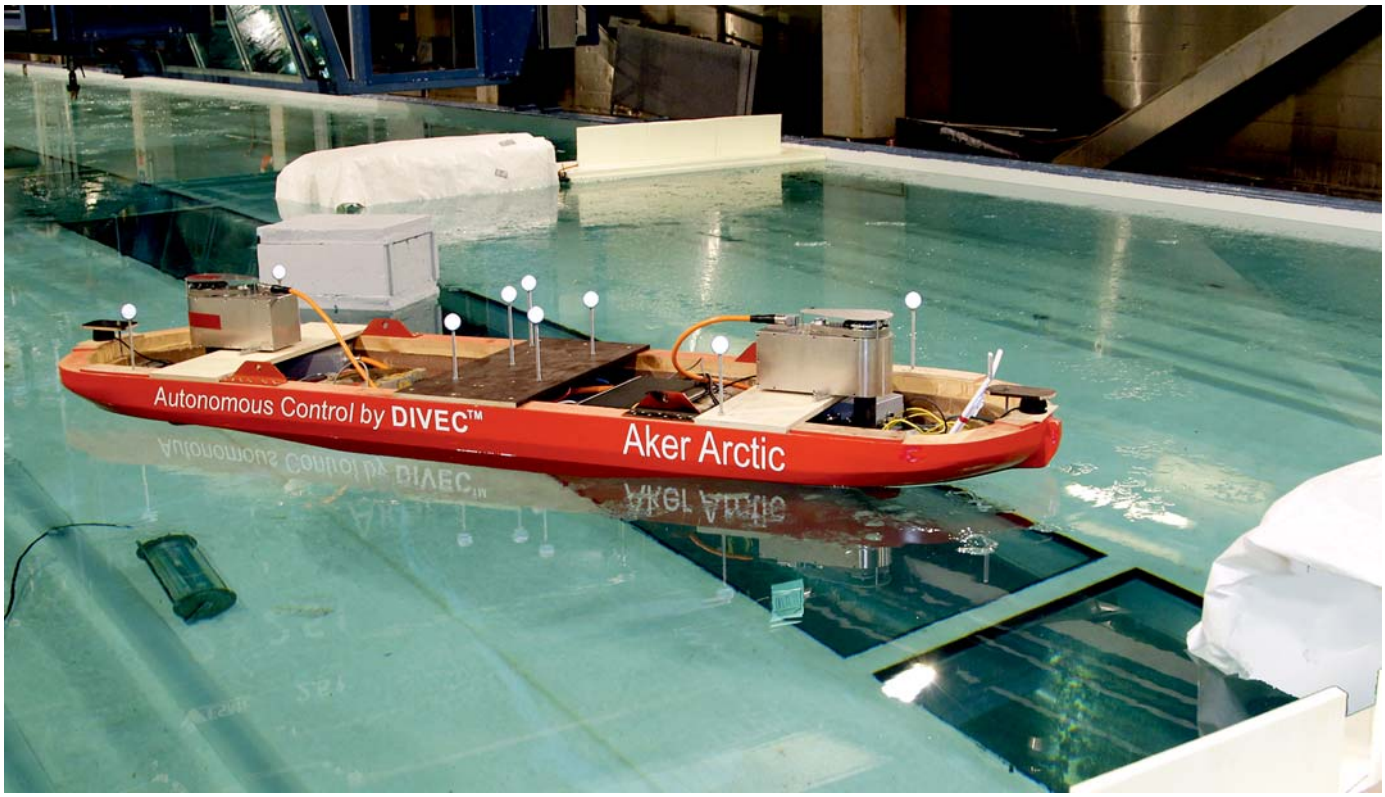
First autonomous model test in ice tank

An autonomous ship model was successfully tested in Aker Arctic's ice model test laboratory in June. In the demonstration test the ship model was able to detect obstacles in the ice tank utilising onboard sensors, manoeuvre around them without operator input, and dock itself automatically to a target pier.



The ice model test laboratory has been prepared so that it is easily adaptable to customers' needs.

The wireless model used in the test was equipped with battery-powered propulsion units, data transfer to the "shore facility", and an autonomous navigation system that routed the vessel around obstacles detected by the onboard sensors.

Plug-and-play

The various components were connected using Distributed Intelligent Vessel Components (DIVEC™), a specially developed network framework that provides a modern protocol for connecting devices and transferring necessary data between them.

"The DIVEC™ software architecture allows reliable communication between different software components," says Development Engineer Jukka-Pekka Sallinen.

"Expanding the network is easy due to the automatic node discovery, and its centralised configuration management enables the development of plug-and-play devices. It is therefore easy to connect third-party software to the model unit such as propulsion control, sensors, dynamic positioning (DP) systems or autonomous control systems, according to the purpose of the testing."

Successful test

The test was carried out with a double-ended ferry model, 3.4 metres long and 0.8 metres wide. It was equipped with azimuth thrusters and two lidar sensors (laser radars), one in each end of the model. The vessel was programmed to perform the task of leaving one pier, travel to its destination pier, dock, then undock and return to origin and dock. Along the route were different obstacles.

The vessel was equipped with a reactive route planner; the lidars detected obstacles and the route planner constantly rerouted the vessel to avoid the obstacles in the environment. The planned route and rerouting could be followed on a computer screen. The environment was scanned with a fast refresh rate in order for the model to reliably detect changing obstacles.

"The test was successful and gave an example of how testing can be carried out," Sallinen says. "At the time of the test the International Marine Design Conference (IMDC) was taking place nearby, and most of the spectators were participating in the conference. The comments we received after the test were extremely positive."

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Ready for customer projects

“Our aim has been to prepare the ice model test laboratory in such way that we can offer an easily customised testing facility to companies developing autonomous shipping,” Sallinen continues.

“We have made major improvements to the testing facility and equipment, such as installation of a wireless system, development of new propulsion units and propulsion control units for thrust allocation. The use of battery power and wireless networks allow us to offer customers completely cable free models.”

All systems are connected through DIVEC™ and it is therefore easy to add new third-party software components depending on the customer's needs.

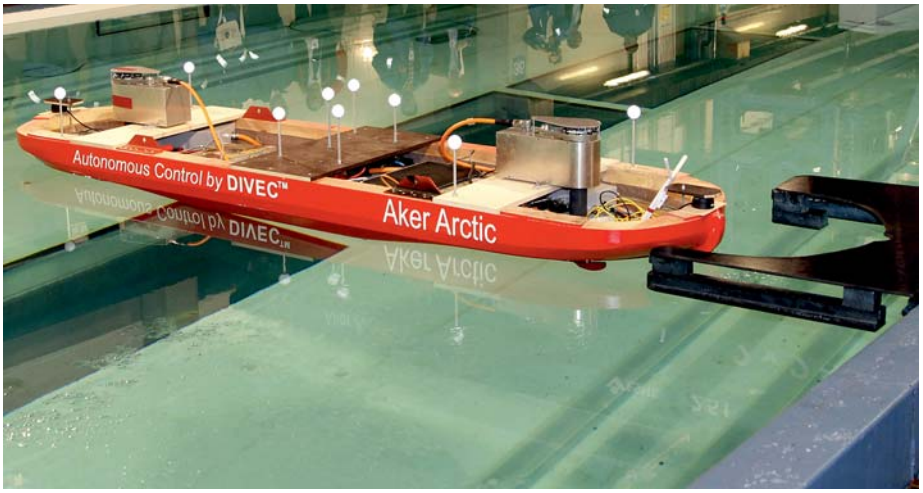
“For example, in the real world vessels use motion reference units, gyrocompasses and satellite navigation systems to establish their location and heading, which is a prerequisite for autonomous operations,” Development Engineer Olli Kokko explains. “However, in the model basin we use a motion capture camera system, which simulates a satellite navigation system and gyrocompass for this purpose. The camera system is from a third-party supplier and integrated to the system with the help of DIVEC™.”

Furthermore, Aker Arctic has a co-operation agreement with Aalto University in Otaniemi for the joint use of both ice tanks for model testing and research purposes.

“When the Aalto ice tank is ready in the near future we can also test autonomous vessels in their 40 by 40 metres square tank which offers an additional benefit especially when testing manoeuvring and other operative model tests,” Sallinen says.

“We are now ready to welcome customers for testing their autonomous vessel systems and help out with their different development stages.”

The video of the model test can be seen at https://youtu.be/7iTMdHjGoso.



In the demonstration test the ship model was able to detect obstacles in the ice tank utilising onboard sensors, manoeuvre around them without operator input and moor itself automatically to a target pier.

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Meet Jukka-Pekka Sallinen

Jukka-Pekka works with various development projects, especially IT related projects, such as the Aker Arctic Ice Simulator, autonomous vessels and the Ice Load Monitoring System. He graduated from Aalto University in 2013 and started to work full time at Aker Arctic with ice model testing. In 2016 he continued the Ice Simulator development and moved to the Electronics and IT-department after it was established.

Jukka-Pekka enjoys longboarding and playing the bass in a band in his spare-time. He also likes working on his two motorcycles and playing with his dog.